UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

STATISTICAL REPORT OF SURVEY

ON

SOUTHERN OREGON - NORTHERN CALIFORNIA

PINE BEETLE CONTROL PROJECT

DURING

SEASON 1927

- - - - - -

Statistical Report No. 6

By

F.P.Keen
Associate Entomologist
U.S. Bureau of Entomology

423 Jordan Hall
Stanford University
Palo Alto, Calif.

Dec.1, 1927

GOVERNMENT PRINTING OFFICE

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PREFACE

Pine beetle surveys were started on the Southern Oregon - Northern California Control Project in 1921. The first purpose of these surveys was to accumulate data as a basis for control recommendations. After the control work was started the surveys also secured information as to the results of the work. And then since an immense amount of data had been collected on a large number of sample plots they were continued after the control work stopped to study the general trend of the infestation in the region and the influences which effect beetle activities.

The present report gives the general information obtained by the seventh annual survey of this area.

The Survey

The survey consisted of a recruise of the sample plots distributed thruout the area. A four-man crew was employed for this work consisting of F.P. Keen, Associate Entomologist-in-Charge; W.J. Buckhorn, M.H. England and H.G. Sabine, Field Assistants. A Ford ton truck belonging to the Bureau of Entomology furnished the transportation of men and camp equipment.

The survey on this project area covered 19,680 acres during the period May 17th to September 1st. From September 1st to October 15th the crew surveyed the Modoc Lava Bed Area which is covered in a separate report.

The cost of the work was as follows:-

Period - May 17 to Sept. 1, 1927 - Man-days 406

Salaries of 4 men - - -	$2,220
Expenses - - - - - - - - -	1,826.64
Total cost of survey -	$4,046.64

Cost per man-day - -	$9.95
Cost per acre cruised	.206

The Survey Data

The Insects

Over seventy-five percent of the loss of western yellow pine on this area is caused by attacks of the western pine beetle (Dendroctonus brevicomis Lec.) The mountain pine beetle and flatheaded borers take second and third places respectively. These three beetles together with a small amount of work by species of Ips cause the death of 98% of the insect killed pines in this region.

Resumé of Past Losses

The surveys which have been conducted on the area since 1921 show that the total loss from insect activity since 1918 has been as follows:-

	Volume Killed. B.F.	Percent of Stand Killed:	
1918	255,500,000	2.0 %	
1919	191,500,000	1.5 %	
1920	123,410,000	.97%	
1921	119,705,000	.94%	Control started.
1922	104,975,000	.82%	" "
1923	74,426,000	.58%	" "
1924	129,355,000	1.01%	Control stopped
1925	252,880,000	1.98%	
1926	278,680,000	2.18%	
Total in 9 yrs.	1,530,431,000	12.0 %	

These surveys show that over a billion and a half feet of pine stumpage has been destroyed by beetles on this area of a million two-hundred thousand acres during the past nine years or a total of 12% of the stand.

These figures also show how the infestation was on the decline during the period 1918 to 1923 and on the increase from 1924 to the present time. The control work which started in 1922 was undoubtedly responsible in past for the reduction in losses during the period 1922 to 1924 but the greatest amount of credit must be given to natural factors since only a relatively small part of the area was treated in control during any one season.

The Present Insect Losses.

Starting with 1923, each year saw an increase in beetle activity. The loss of 1924 doubled over that of 1923. The loss of 1925 nearly doubled over that of 1924; and 1926 saw further increase. Only on Area 1 was a reduction secured. Here the infestation dropped from 1.97% of the stand in 1925 to 1.41% of the stand in 1926. On the other areas the infestation increased to 2.50% of the stand. This reduction on Area 1 can only be explained as due to the very efficient control operations which were carried on in certain units during 1925. All other factors appear to be the same on this as on the other three areas of the region, so that logically the infestation should have increased in 1926 had it not been for the control work.

On uncontrolled areas 1927 saw a further increase in beetle killing. This was surprising since the 1926-27 winter was above normal in precipitation and it was expected that improved moisture conditions would be reflected in better growth and less beetle loss. But the growing season was so short that the trees put on slightly less growth than they did in either 1925 or 1926 and the beetles through force of numbers increased their inroads upon the pine stands. However, the increase in losses for 1927 were not uniform over the area and certain units which had recently been highly epidemic showed a decrease in loss. It is expected, therefore, that if 1927-28 is a season of normal precipitation and results in improved growth conditions, beetle losses will be decidedly reduced in all of the heavier epidemic centers.

For 1926 the heaviest loss on any of the check sections occurred in the Sycan Unit of Area 2. On this section (Sec.2 T 34 S R 12E) 1283 trees containing 945,780 board feet were killed during the year. This loss represented 6.94% of the timber stand.

The Whitworth check section with 989 trees and the Willow Flat check section with 980 trees killed during the year showed the next heaviest losses.

The infestation of 1926 and 1927 ran heavily to groups with many groups of "black jacks" and poles falling victims to beetle attacks. This killing of the younger tree in the stand was probably made possible by the greatly reduced growth rate of all trees in the stand due to the series of dry years and the increased root competition where many trees rely upon a limited area of soil for their moisture supply.

Control Conducted During the Period

Due to lack of Federal funds, control work on Areas 2 and 3 stopped at the end of 1924.

The Klamath Forest Protective Association, however, continued to carry on control operations on the private lands of Area 1.

In the fall of 1925 control work on Area 1 was resumed on seven sections in the Spencer Creek drainage of the Clover Station Unit were treated. During the following spring (1926) the remainder of the Clover Station Unit was covered with control work.

In the fall of 1926 about nine sections on the east side of Aspen Lake were treated and in the following spring an extensive program of control was conducted in the Aspen Lake Unit, Round Lake Unit, Clover Station Unit, Johnson Prairie Unit and the Chase Butte Unit.

At the present time (Fall of 1927) several control camps are established in the Bly District of Area 3 and infested timber is being treated by both the Association and the Forest Service.

Table I gives the amounts of control work conducted during 1925-27 by the Klamath Forest Protective Association, in terms of trees, treated, volume treated, acres covered and cost. This beetle control campaign is the largest ever conducted by private timber owners without Federal assistance.

Results of Control

That the money spent by the private owners in this control work has not been spent in vain is very conclusively shown by the results which have been obtained.

Twelve sections in the Clover Station Unit were treated during the fall control of 1925 and the spring control of 1926, and were again covered by spotting and control operations in 1927. Table 2 gives a comparison of these two cruises and shows the substantial reduction which was secured on every section but one. The average reduction for the fall control work was 64% and the average for the spring work was a reduction of 70%. Moreover, this reduction was secured in the face of a general increase in infestation or other areas, which makes the results all the more outstanding.

The loss on this unit in 1925 when the control work was undertaken, amounted to 12,600,000 board feet. If no control work had been done it is reasonable to assume that the 30% increase which occurred on Areas 2 and 3 would have occurred on this unit as well. Therefore, the loss for 1926 on the unit could easily have been 16,400,000 board feet. However, as a result of the control work the 1926 loss was only 6,900,000 board feet. This left a profit of 9,500,00 board feet saved valued at $6.50 per thousand or a total of $61,750. The cost of the work was about $16,600 thus leaving a net profit for the one year of over $45,000. To this should be added the saving in sebsequent years which will result from the general reduction in the infestation. The effect of the work will probably be felt for about three years before it is completely overcome by other factors.

The result on the Clover Station unit is a very outstanding example of the effectiveness of control when applied against a naturally increasing infestation, and show that under such condition the application of control work to valuable stands is well worth while, and brings a dollar and cents return for the money invested.

Future Work

Control Work

The timber owners of Southern Oregon being convinced of the benefits of control work are evidently going ahead with their fight against the pine beetle in their more valuable stands and are prepared to spend thousands of dollars in this campaign.

To make this work effective it will frequently be necessary for the government to clean up adjoining lands under Federal control. Funds should be available for such work at all times so that the government will not be placed in the unfavorable role of a shiftless neighbor harboring pests which are a menace of the property of adjacent owners.

Future Studies

The survey and studies which have been made to date give a very good basis for analyzing the results of control work as carried on under commercial conditions. It is hoped that these studies can be put in final shape during the coming winter.

There is still a great deal which may be gained by continuing the surveys of a limited number of the check plots and it is hoped that funds for this work may be made available. Such work may throw considerable light upon the causes of epidemics, and their relation to the weather, condition of the stand, site, and other factors, and in this way give a clue as to how forests may be managed to avoid epidemic insect losses.

TABLE NO. 1

CONTROL WORK CONDUCTED DURING PERIOD[1]

1925-1927
in
AREA 1.

Control Period	Unit Treated	Trees Treated	Volume Treated	Acres Covered.	Cost
Fall 1925	Clover Sta.	1,406	1,558,729	4,000	$ 5,027.56
Spring 1926	Clover Sta.	4,807	6,416,011	19,680	13,415.57
Fall 1926	Aspen Lake	465	716,229	5,440	--
Spring 1927	Aspen Lake	598	--	2,680	--
	Chase Butte	146		1,080	
	Clover Sta.	850	6,095,879	7,080	
	Johnson Prairie	1,045		6,600	
	Round Lake	1,468		7,120	
Total Fall 1926 Spring 1927.		4,479	6,812,108	30,000	$ 18,231.12

(1) Figures supplied through courtesy of Klamath Forest Protective Association.

TABLE 2.

REDUCTION IN LOSS DUE TO CONTROL

ON AREA 1.

Clover Station Unit
1925 to 1926[1]

Sections Treated.	Treated Loss in 1925 (Winter Trees Only)	Next years Loss (Winter trees only)	
Fall Control 1925			
T 38 S R 6 E Sec. 35	41	46	
" " " 36[2].	279	98	
T 39 R 6 E Sec. 1	239	79	
" " " 2	167	33	
" " " 11	136	56	
" " " 14	106	82	
T 39 R 7 " 6	395	96	
Totals	1363	490	Reduction - Trees -873
			Percent 64%
Spring Control 1926			
T 39 S R 7 E Sec. 5	304	58	
" " " 7	260	101	
T 39 S R 6 E Sec. 12	266	81	
T 38 S R 7 E " 31	184	53	
T 39 S R 7 E " 16[2].	285	95	
	1299	388	Reduction - Trees - 911
			Percent 70%

1. Figures obtained by 100% cruise of sections before and after treatment, make by control crew spotters of the Klamath Forest Protective Association during control operations.

2. Check sections of U.S. Bureau of Entomology.

TABLE #3

Survey of 1927
Summary of Cruising Data on Check Sections

Area 1.

Unit	Location T	R	Sec.	Acres	Date of Cruise 1927	1925 Loss Total Trees Marked I.S.	I.W.	Treated	Total	1926 Loss Total Trees Marked J.S.	J.W.	Treated	Total	Remarks
Aspen Lake	37S	7E	34	640	7/8	59	61	0	120	89	17	48	154	Treated in fall 1926
Clover Station	38S	6E	36	640	7/13	150	163	279	592	77	33	98	208	Treated Fall 1925 & Spring 1927
" "	39S	7E	16	640	7/15	126	15	285	426	86	95	0	181	Treated in Spring 1926
Eagle Ridge	37S	7E	16	640	7/16	76	117	0	193	78	123	0	201	-
Jenny Creek	39S	4E	33	640	7/22	106	41	0	147	77	83	0	160	-
" "	40S	4E	34	640	7/30	258	135	0	393	183	176	0	359	-
Johnson Prairie	39S	5E	7	640	7/21	92	52	0	144	46	20	54	120	Treated in Spring 1927
Klamath Canyon	41S	6E	9	320	8/3	123	44	0	167	77	72	0	149	-
Pokegama	40S	5E	36	640	7/19	132	45	0	177	192	134	0	326	-
Round Lake	39S	8E	15	640	7/11	244	160	0	404	281	32	129	442	Treated in Spring 1927
Totals				6080		1366	833	564	2763	1186	785	329	2300	

TABLE #4

Survey of 1927
Summary of Cruising Data on Check Sections

Area 2.

Unit	Location T	R	Sec.	Acres	Date of Cruise 1927	1925 Loss Total Trees Marked I.S.	I.W.	Treated	Total	1926 Loss Total Trees Marked J.S.	J.W.	Treated	Total	Remarks
Antelope	36S	8E	28	640	8/6	108[1]	159[1]	0	267[1]	113	188	0	301	-
Chiloquin	37S	7E	24	640	8/9	44	44	0	88	43	171	0	214	Logged off.
Ferguson	35S	13E	33	640	8/13	416	255	0	671	344	370	0	714	-
Gerber	38S	13E	24	640	6/30	221[1]	233[1]	0	454[1]	298	300	0	598	-
Goodlowe	39S	13E	5	640	6/28	65[1]	89[1]	0	154[1]	78	129	0	207	-
Hildebrand	37S	11E	21 5/8	320	5/22	43[1]	69[1]	0	112[1]	55	86	0	141	-
Royston	38S	12E	10	640	5/24	90[1]	97[1]	0	187[1]	93	189	0	282	-
Sprague	34S	8E	32	320	8/11	-	-	-	-	15	145	0	160	Logged area
"	34S	8E	31	160	8/12	-	-	-	-	172	189	0	361	Unlogged "
Syoan	34S	12E	2	640	8/17	282[1]	303[1]	0	585[1]	455	828	0	1283	-
Willow Flat	37S	14E	20	640	5/27	293	345	0	638	432	548	0	980	-
Totals				5920		1562	1594		3156	2098	3142		5241	

1. Marked in 1926.

TABLE #5

Survey of 1927
Summary of Cruising Data on Check Sections

Area 3

Unit	Location T	R	Sec.	Acres	Date of Cruise 1927	1925 Loss[1] Total Trees Marked I.S.	I.W.	Treated	Total	1926 Loss Total Trees Marked J.S.	J.W.	Treated	Total	Remarks
Crowder Flat	47N	11E	18	640	9/1	168	180	0	348	233	347	0	580	-
"	47N	12E	4	640	9/8	33	28	0	61	50	58	0	108	-
Deming Creek	36S	15E	8	640	6/14	81	97	0	178	222	204	0	426	Treated in 1924
" "	36S	15E	25	640	6/2	149	124	0	273	102	155	0	257	-
Horsefly	38S	14E	13	640	9/14	85	122	0	207	489	300	0	789	Burned in 1924
"	"	"	36	640	6/25	127	205	0	332	411	386	0	797	-
Merritt Creek	33S	14E	34	640	9/9	67	79	0	146	96	102	0	198	-
Meryl Creek	35S	14E	11	640	6/10	196	271	0	467	283	399	0	682	-
" "	35S	15E	20	640	6/4	149	265	0	414	271	248	0	519	-
Owens	38S	15E	1	640	6/16	76	93	0	169	165	63	0	228	-
Quartz	38S	17E	7E½	320	6/23	29	50	0	79	54	68	0	122	-
"	"	"	8W½	320	6/22	44	48	0	92	65	108	0	173	-
Whiteworth	37S	16E	17	640	6/18	363	382	0	745	442	547	0	989	-
Totals				7680		1567	1944		3511	2883	2985		5868	

1. Marked in 1926.

Summary of Yellow Pine Losses for 1926
Area #1

Unit	No. of Trees Killed	Av. Volume per tree	Volume Killed	Stumpage Value	Value of Loss	Per cent of Stand Killed	Loss per Acre Bd. ft.	Av. Number Trees Killed Per Sec.
Aspen Lake[1,2,6]	4,300	900	3,870,000	$ 6.50	$25,155	1.47%	228	162
Big Bend[2,3]	1,300	1000	1,300,000	6.50	8,450	1.89	177	114
Chase Butte[2,6]	2,100	1000	2,100,000	5.50	11,550	1.62	168	117
Clover Sta.[2,4,5,6]	6,900	1000	6,900,000	6.50	44,859	.99	133	85
Eagle Ridge[1,6]	3,400	1100	3,960,000	7.50	29,700	2.04	221	128
Jenny Creek[2]	5,900	700	4,130,000	5.50	22,715	1.10	91	83
Johnson Prairie[6]	4,600	1500	6,900,000	5.50	37,950	1.14	143	61
Klamath Canyon[3]	2,700	500	1,350,000	3.50	4,725	2.28	120	153
Pokegama[2]	11,000	900	9,900,000	5.50	54,450	1.26	201	143
Round Lake[1,2,6]	5,400	1100	5,940,000	6.50	38,610	1.73	324	188
Topsy[3]	4,000	1000	4,000,000	6.50	26,000	1.56	157	103
Worden[3]	2,200	1000	2,200,000	5.50	12,100	3.45	294	188
Totals	54,000	975	52,550,000	$6.02	$316,255	1.41%	169	111

1. Unit on which 1921 loss was treated.
2. " " " 1922 " " "
3. " " " 1923 " " "
4. " " " 1924 " " "
5. " " " 1925 " " "
6. " " " 1926 " " "

Summary of Yellow Pine Losses for 1926
Area #2

Unit	No. of Trees Killed	Av. Volume per tree	Volume Killed	Stumpage Value	Value of Loss	Per Cent of Stand Killed	Loss per Acre Bd. ft.	Av. Number Trees Killed per Sec.
Algoma[1]	1,800	800	1,440,000	$5.50	$7,920	3.32	167	134
Antelope[2]	5,800	800	4,640,000	5.50	25,820	1.42	186	148
Black Hills[3]	24,000	800	19,200,000	4.50	86,400	3.62	512	410
Bly	11,200	700	7,840,000	5.00	39,200	2.97	280	256
Chiloquin[2]	3,700	400	1,480,000	5.50	8,140	.67	68	109
Ferguson[3]	6,000	800	4,800,000	4.50	21,600	4.29	424	340
Gerber	2,400	700	1,680,000	4.00	6,720	5.55	294	270
Goodlowe	3,500	700	2,450,000	4.00	9,800	3.25	199	183
Hildebrand[3]	4,000	600	2,400,000	5.50	13,200	1.40	141	150
Rock Canyon[3]	4,700	600	2,820,000	5.00	14,100	1.83	231	247
Royston[3]	5,000	600	3,000,000	4.50	13,500	1.75	247	263
Saddle Mt.[2]	12,000	700	8,400,000	5.50	46,200	2.11	214	195
Shoner[1]	1,900	500	950,000	5.50	5,225	.90	77	98
Sprague[2]	3,800	400	1,520,000	6.50	9,880	2.49	283	450
Squaw Flat[2]	4,200	700	2,940,000	5.50	16,170	1.69	187	172
Swan[1]	4,500	700	3,150,000	5.50	17,325	2.19	215	196
Sycan[4]	30,000	800	24,000,000	4.00	96,000	4.28	598	480
Trout Creek[2]	10,200	700	7,140,000	5.50	39,270	1.99	208	190
Whiskey Creek[3]	6,500	700	4,550,000	5.00	22,750	1.47	181	166
Willow Flat[3]	20,800	600	12,480,000	5.00	62,400	3.23	382	407
Yainax[3]	4,000	700	2,800,000	5.50	15,400	1.48	178	163
Total	170,000	700	119,680,000	$4.83	$577,020	2.50	281	256

1. Units on which 1921 loss was treated.
2. " " " 1922 " " "
3. " " " 1923 " " "
4. " " " 1924 " " "

TABLE NO. 8

Summary of Yellow Pine Losses for 1926
Area #3

Unit	No. of Trees Killed	Av. Volume per tree	Volume Killed	Stumpage Value	Value of Loss	Per Cent of Stand Killed	Loss per Acre Bd. Ft.	Av. Number Trees Killed per Sec.
Barnes Valley	10,000	700	7,000,000	$3.50	$24,500	2.07	161	147
Crowder Flat[2,3]	16,500	900	14,850,000	4.00	59,400	1.70	163	116
Deming Creek[2,4]	7,500	700	5,250,000	5.00	26,250	2.21	158	145
Dog Lake	8,000	800	6,400,000	3.50	22,400	1.66	121	96
Four Mile	5,000	800	4,000,000	3.50	14,000	1.30	104	83
Hay Creek	4,000	700	2,800,000	3.50	9,800	1.52	147	134
Horsefly[1,2,3]	25,000	800	20,000,000	5.00	100,000	6.75	495	400
Merritt Creek	4,000	700	2,800,000	4.00	11,200	1.95	128	117
Meryl Creek[2]	18,000	800	14,400,000	5.00	72,000	2.81	228	182
Owens [1,3]	13,000	900	11,700,000	5.00	58,500	3.58	306	217
Quartz Valley[3]	7,500	800	6,000,000	4.50	27,000	2.02	178	143
Scab Rock	7,500	700	5,250,000	3.50	18,375	3.56	268	245
Whitworth Cr.[2]	10,000	600	6,000,000	5.00	30,000	3.30	175	187
Totals	136,000	782	106,450,000	$4.45	$473,425	2.52	201	164

1. Units on which 1921 loss was treated.
2. " " " 1922 " " "
3. " " " 1923 " " "
4. " " " 1924 " " "

TABLE NO. 9

PROJECT TOTALS

Summary of Yellow Pine Loss For 1926

Items	Area 1	Area 2	Area 3	Totals
Number of trees killed	54,000	170,000	136,000	360,000
Average volume per tree	975	700	782	775
Volume killed	32,550,000	119,680,000	106,450,000	278,680,000
Average value per M.B.M.	$6.02	$4.83	$4.45	$4.90
Value of stumpage lost	$316,255	$577,020	$473,425	$1,366,700
Percent of stand killed.	1.41%	2.50%	2.52%	2.16%
Loss in board feet per acre	169	281	201	220
Average number trees killed per sec.	111	256	164	182